BANK MADE (110)

SEQUENCE LISTING

110> Lehmann, Martin Lassen, Soren F

<120> Improved Phytases

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July 1

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Leu Val Gln Val Leu Ser Arg His Gly Ala Arg Tyr Pro Thr Ser Ser 50 55 60

Lys Ser Lys Lys Tyr Lys Lys Leu Val Thr Ala Ile Gln Ala Asn Ala 65 70 75 80

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Leu Gly Ala Asp Asp Leu Thr Pro Phe Gly Glu Gln Gln Leu Val Asn 100 105 110

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Leu Val Gln Val Leu Ser Arg His Gly Ala Arg Tyr Pro Thr Ser Ser 50 55 60

Lys Ser Lys Lys Tyr Lys Lys Leu Val Thr Ala Ile Gln Ala Asn Ala 65 70 75 80

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Ala Thr Asn Arg Ala Ala Pro Ala Ile Ser Val Ile Ile Pro Glu Ser 165 170 175

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Lys Tyr Tyr Gly Tyr Gly Ala Gly Ser Pro Leu Gly Pro Ala Gln Gly 275 280 Ile Gly Phe Thr Asn Glu Leu Ile Ala Arg Leu Thr Gln Ser Pro Val 290 Gln Asp Asn Thr Ser Thr Asn His Thr Leu Asp Ser Asn Pro Ala Thr 305 Phe Pro Leu Asp Arg Lys Leu Tyr Ala Asp Phe Ser His Asp Asn Ser 325 Met Ile Ser Ile Phe Phe Ala Met Gly Leu Tyr Asn Gly Thr Gln Pro Leu Ser Met Asp Ser Val Glu Ser Ile Gln Glu Met Asp Gly Tyr Ala Ala Ser Trp Thr Val Pro Phe Gly Ala Arg Ala Tyr Phe Glu Leu Met Gln Cys Glu Lys Lys Glu Pro Leu Val Arg Val Leu Val Asn Asp Arg 390 Val Val Pro Leu His Gly Cys Ala Val Asp Lys Phe Gly Arg Cys Thr 405 410 Leu Asp Asp Trp Val Glu Gly Leu Asn Phe Ala Arg Ser Gly Gly Asn 425 Trp Lys Thr Cys Phe Thr Leu 435 <210> 12 <211> 443 <212> PRT <213> Talaromyces Thermophilus <400> 12 Asp Ser His Ser Cys Asn Thr Val Glu Gly Gly Tyr Gln Cys Arg Pro 5 10 Glu Ile Ser His Ser Trp Gly Gln Tyr Ser Pro Phe Phe Ser Leu Ala 20 25 Asp Gln Ser Glu Ile Ser Pro Asp Val Pro Gln Asn Cys Lys Ile Thr 35 40

Phe Val Gln Leu Leu Ser Arg His Gly Ala Arg Tyr Pro Thr Ser Ser 50 55 Lys Thr Glu Leu Tyr Ser Gln Leu Ile Ser Arg Ile Gln Lys Thr Ala Thr Ala Tyr Lys Gly Tyr Tyr Ala Phe Leu Lys Asp Tyr Arg Tyr Gln 85 Leu Gly Ala Asn Asp Leu Thr Pro Phe Gly Glu Asn Gln Met Ile Gln 105 Leu Gly Ile Lys Phe Tyr Asn His Tyr Lys Ser Leu Ala Arg Asn Ala 120 Val Pro Phe Val Arg Cys Ser Gly Ser Asp Arg Val Ile Ala Ser Gly Arg Leu Phe Ile Glu Gly Phe Gln Ser Ala Lys Val Leu Asp Pro His 155 Ser Asp Lys His Asp Ala Pro Pro Thr Ile Asn Val Ile Ile Glu Glu 165 Gly Pro Ser Tyr Asn Asn Thr Leu Asp Thr Gly Ser Cys Pro Val Phe 180 185 190 Glu Asp Ser Ser Gly Gly His Asp Ala Gln Glu Lys Phe Ala Lys Gln 195 200 Phe Ala Pro Ala Ile Leu Glu Lys Ile Lys Asp His Leu Pro Gly Val 210 215 Asp Leu Ala Val Ser Asp Val Pro Tyr Leu Met Asp Leu Cys Pro Phe 225 230 235 Glu Thr Leu Ala Arg Asn His Thr Asp Thr Leu Ser Pro Phe Cys Ala 245 250 Leu Ser Thr Gln Glu Glu Trp Gln Ala Tyr Asp Tyr Tyr Gln Ser Leu 260 265 Gly Lys Tyr Tyr Gly Asn Gly Gly Asn Pro Leu Gly Pro Ala Gln 275 280

Gly Val Gly Phe Val Asn Glu Leu Ile Ala Arg Met Thr His Ser Pro Val Gln Asp Tyr Thr Thr Val Asn His Thr Leu Asp Ser Asn Pro Ala 310 Thr Phe Pro Leu Asn Ala Thr Leu Tyr Ala Asp Phe Ser His Asp Asn Thr Met Thr Ser Ile Phe Ala Ala Leu Gly Leu Tyr Asn Gly Thr Ala Lys Leu Ser Thr Thr Glu Ile Lys Ser Ile Glu Glu Thr Asp Gly Tyr 360 Ser Ala Ala Trp Thr Val Pro Phe Gly Gly Arg Ala Tyr Ile Glu Met 370 375 Met Gln Cys Asp Asp Ser Asp Glu Pro Val Val Arg Val Leu Val Asn 385 390 Asp Arg Val Val Pro Leu His Gly Cys Glu Val Asp Ser Leu Gly Arg 405 410 Cys Lys Arg Asp Asp Phe Val Arg Gly Leu Ser Phe Ala Arg Gln Gly 420 425 Gly Asn Trp Glu Gly Cys Tyr Ala Ala Ser Glu 435 <210> 13 <211> 466 <212> PRT <213> Myceliophthora thermophila <400> 13 Glu Ser Arg Pro Cys Asp Thr Pro Asp Leu Gly Phe Gln Cys Gly Thr Ala Ile Ser His Phe Trp Gly Gln Tyr Ser Pro Tyr Phe Ser Val Pro Ser Glu Leu Asp Ala Ser Ile Pro Asp Asp Cys Glu Val Thr Phe Ala 40 Gln Val Leu Ser Arg His Gly Ala Arg Ala Pro Thr Leu Lys Arg Ala

Ala Ser Tyr Val Asp Leu Ile Asp Arg Ile His His Gly Ala Ile Ser Tyr Gly Pro Gly Tyr Glu Phe Leu Arg Thr Tyr Asp Tyr Thr Leu Gly Ala Asp Glu Leu Thr Arg Thr Gly Gln Gln Met Val Asn Ser Gly Ile Lys Phe Tyr Arg Arg Tyr Arg Ala Leu Ala Arg Lys Ser Ile Pro Phe Val Arg Thr Ala Gly Gln Asp Arg Val Val His Ser Ala Glu Asn Phe Thr Gln Gly Phe His Ser Ala Leu Leu Ala Asp Arg Gly Ser Thr Val Arg Pro Thr Leu Pro Tyr Asp Met Val Val Ile Pro Glu Thr Ala Gly Ala Asn Asn Thr Leu His Asn Asp Leu Cys Thr Ala Phe Glu Glu Gly Pro Tyr Ser Thr Ile Gly Asp Asp Ala Gln Asp Thr Tyr Leu Ser Thr Phe Ala Gly Pro Ile Thr Ala Arg Val Asn Ala Asn Leu Pro Gly Ala Asn Leu Thr Asp Ala Asp Thr Val Ala Leu Met Asp Leu Cys Pro Phe Glu Thr Val Ala Ser Ser Ser Ser Asp Pro Ala Thr Ala Asp Ala Gly Gly Gly Asn Gly Arg Pro Leu Ser Pro Phe Cys Arg Leu Phe Ser

Glu Ser Glu Trp Arg Ala Tyr Asp Tyr Leu Gln Ser Val Gly Lys Trp

Tyr Gly Tyr Gly Pro Gly Asn Pro Leu Gly Pro Thr Gln Gly Val Gly

Phe Val Asn Glu Leu Leu Ala Arg Leu Ala Gly Val Pro Val Arg Asp 305 315 Gly Thr Ser Thr Asn Arg Thr Leu Asp Gly Asp Pro Arg Thr Phe Pro Leu Gly Arg Pro Leu Tyr Ala Asp Phe Ser His Asp Asn Asp Met Met Gly Val Leu Gly Ala Leu Gly Ala Tyr Asp Gly Val Pro Pro Leu Asp Lys Thr Ala Arg Arg Asp Pro Glu Glu Leu Gly Gly Tyr Ala Ala Ser Trp Ala Val Pro Phe Ala Ala Arg Ile Tyr Val Glu Lys Met Arg Cys 395 Ser Gly Gly Gly Gly Gly Gly Gly Glu Gly Arg Gln Glu Lys Asp Glu Glu Met Val Arg Val Leu Val Asn Asp Arg Val Met Thr Leu 425 430 Lys Gly Cys Gly Ala Asp Glu Arg Gly Met Cys Thr Leu Glu Arg Phe 435 440 Ile Glu Ser Met Ala Phe Ala Arg Gly Asn Gly Lys Trp Asp Leu Cys 450 455 460 Phe Ala 465 <210> 14 <211> 441 <212> PRT <213> Artificial Sequence <220> <223> Synthetic <400> 14 Asn Ser His Ser Cys Asp Thr Val Asp Gly Gly Tyr Gln Cys Phe Pro 10

Glu Ile Ser His Leu Trp Gly Gln Tyr Ser Pro Tyr Phe Ser Leu Glu

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		35					40					45				

- Phe Val Gln Val Leu Ser Arg His Gly Ala Arg Tyr Pro Thr Ser Ser 50 60
- Lys Ser Lys Ala Tyr Ser Ala Leu Ile Glu Ala Ile Gln Lys Asn Ala 65 70 75 80
- Thr Ala Phe Lys Gly Lys Tyr Ala Phe Leu Lys Thr Tyr Asn Tyr Thr 85 90 95
- Leu Gly Ala Asp Asp Leu Thr Pro Phe Gly Glu Asn Gln Met Val Asn 100 105 110
- Ser Gly Ile Lys Phe Tyr Arg Arg Tyr Lys Ala Leu Ala Arg Lys Ile 115 120 125
- Val Pro Phe Ile Arg Ala Ser Gly Ser Asp Arg Val Ile Ala Ser Ala 130 135 140
- Glu Lys Phe Ile Glu Gly Phe Gln Ser Ala Lys Leu Ala Asp Pro Gly 145 150 155 160
- Ser Gln Pro His Gln Ala Ser Pro Val Ile Asp Val Ile Ile Pro Glu 165 170 175
- Gly Ser Gly Tyr Asn Asn Thr Leu Asp His Gly Thr Cys Thr Ala Phe 180 185 190
- Glu Asp Ser Glu Leu Gly Asp Asp Val Glu Ala Asn Phe Thr Ala Leu 195 200 205
- Phe Ala Pro Ala Ile Arg Ala Arg Leu Glu Ala Asp Leu Pro Gly Val 210 215 220
- Thr Leu Thr Asp Glu Asp Val Val Tyr Leu Met Asp Met Cys Pro Phe 225 230 235 240
- Glu Thr Val Ala Arg Thr Ser Asp Ala Thr Glu Leu Ser Pro Phe Cys 245 250 255
- Ala Leu Phe Thr His Asp Glu Trp Arg Gln Tyr Asp Tyr Leu Gln Ser 260 265 270

Leu Gly Lys Tyr Tyr Gly Tyr Gly Ala Gly Asn Pro Leu Gly Pro Ala 275 280 Gln Gly Val Gly Phe Ala Asn Glu Leu Ile Ala Arg Leu Thr Arg Ser 290 Pro Val Gln Asp His Thr Ser Thr Asn His Thr Leu Asp Ser Asn Pro 305 310 Ala Thr Phe Pro Leu Asn Ala Thr Leu Tyr Ala Asp Phe Ser His Asp 330 Asn Ser Met Ile Ser Ile Phe Phe Ala Leu Gly Leu Tyr Asn Gly Thr Ala Pro Leu Ser Thr Thr Ser Val Glu Ser Ile Glu Glu Thr Asp Gly Tyr Ser Ala Ser Trp Thr Val Pro Phe Gly Ala Arg Ala Tyr Val Glu 375 Met Met Gln Cys Gln Ala Glu Lys Glu Pro Leu Val Arg Val Leu Val 385 395 Asn Asp Arg Val Val Pro Leu His Gly Cys Ala Val Asp Lys Leu Gly 405 410 Arg Cys Lys Arg Asp Asp Phe Val Glu Gly Leu Ser Phe Ala Arg Ser 420 Gly Gly Asn Trp Ala Glu Cys Phe Ala <210> 15 <211> 1426 <212> DNA <213> Artificial Sequence <220> <223> Synthetic <220> <221> CDS <222> (12)..(1412) <223>

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tct Ser	tgt Cys 5	gac Asp	act Thr	gtt Val	gac Asp	ggt Gly 10	ggt Gly	tac Tyr	caa Gln	tgt Cys	ttc Phe 15	cca Pro	gaa Glu	att Ile	tct Ser	146
cac His 20	ttg Leu	tgg Trp	ggt Gly	caa Gln	tac Tyr 25	tct Ser	cca Pro	tac Tyr	ttc Phe	tct Ser 30	ttg Leu	gaa Glu	gac Asp	gaa Glu	tct Ser 35	194
gct Ala	att Ile	tct Ser	cca Pro	gac Asp 40	gtt Val	cca Pro	gac Asp	gac Asp	tgt Cys 45	aga Arg	gtt Val	act Thr	ttc Phe	gtt Val 50	caa Gln	242
gtt Val	ttg Leu	tct Ser	aga Arg 55	cac His	ggt Gly	gct Ala	aga Arg	tac Tyr 60	cca Pro	act Thr	tct Ser	tct Ser	aag Lys 65	tct Ser	aag Lys	290
gct Ala	tac Tyr	tct Ser 70	gct Ala	ttg Leu	att Ile	gaa Glu	gct Ala 75	att Ile	caa Gln	aag Lys	aac Asn	gct Ala 80	act Thr	gct Ala	ttc Phe	338
aag Lys	ggt Gly 85	aag Lys	tac Tyr	gct Ala	ttc Phe	ttg Leu 90	aag Lys	act Thr	tac Tyr	aac Asn	tac Tyr 95	act Thr	ttg Leu	ggt Gly	gct Ala	386
gac Asp 100	gac Asp	ttg Leu	act Thr	cca Pro	ttc Phe 105	ggt Gly	gaa Glu	aac Asn	caa Gln	atg Met 110	gtt Val	aac Asn	tct Ser	ggt Gly	att Ile 115	434
aag Lys	ttc Phe	tac Tyr	aga Arg	aga Arg 120	tac Tyr	aag Lys	gct Ala	ttg Leu	gct Ala 125	aga Arg	aag Lys	att Ile	gtt Val	cca Pro 130	ttc Phe	482
att Ile	aga Arg	gct Ala	tct Ser 135	ggt Gly	tct Ser	gac Asp	aga Arg	gtt Val 140	att Ile	gct Ala	tct Ser	gct Ala	gaa Glu 145	aag Lys	ttc Phe	530
att Ile	gaa Glu	ggt Gly 150	ttc Phe	caa Gln	tct Ser	gct Ala	aag Lys 155	ttg Leu	gct Ala	gac Asp	cca Pro	ggt Gly 160	tct Ser	caa Gln	cca Pro	578
cac	caa	gct	tct	cca	gtt	att	gac	gtt	att	att	cca	gaa	gga	tcc	ggt	626

His Gln Ala Ser Pro Val Ile Asp Val Ile Ile Pro Glu Gly Ser Gly 165 170 175	
tac aac aac act ttg gac cac ggt act tgt act gct ttc gaa gac tct Tyr Asn Asn Thr Leu Asp His Gly Thr Cys Thr Ala Phe Glu Asp Ser 180 185 190	674
gaa ttg ggt gac gac gtt gaa gct aac ttc act gct ttg ttc gct cca Glu Leu Gly Asp Asp Val Glu Ala Asn Phe Thr Ala Leu Phe Ala Pro 200 205	722
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gac cac act tct act aac cac act ttg gac tct aac cca gct act ttc Asp His Thr Ser Thr Asn His Thr Leu Asp Ser Asn Pro Ala Thr Phe 310 315 320	1058
cca ttg aac gct act ttg tac gct gac ttc tct cac gac aac tct atg Pro Leu Asn Ala Thr Leu Tyr Ala Asp Phe Ser His Asp Asn Ser Met 325 330 335	1106
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tgt caa gct gaa aag gaa cca ttg gtt aga gtt ttg gtt aac gac aga Cys Gln Ala Glu Lys Glu Pro Leu Val Arg Val Leu Val Asn Asp Arg	1298
gtt gtt cca ttg cac ggt tgt gct gtt gac aag ttg ggt aga tgt aag Val Val Pro Leu His Gly Cys Ala Val Asp Lys Leu Gly Arg Cys Lys	1346

405 410 415

aga gac gac ttc gtt gaa ggt ttg tct ttc gct aga tct ggt ggt aac Arg Asp Asp Phe Val Glu Gly Leu Ser Phe Ala Arg Ser Gly Gly Asn 420 430 435

1394

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1426

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<212> PRT

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Thr Ser Gly Thr Ala Leu Gly Pro Arg Gly Asn Ser His Ser Cys Asp -10 -5 -1 1 5

Thr Val Asp Gly Gly Tyr Gln Cys Phe Pro Glu Ile Ser His Leu Trp

Gly Gln Tyr Ser Pro Tyr Phe Ser Leu Glu Asp Glu Ser Ala Ile Ser 25 30 35

Pro Asp Val Pro Asp Asp Cys Arg Val Thr Phe Val Gln Val Leu Ser 40 45 50

Arg His Gly Ala Arg Tyr Pro Thr Ser Ser Lys Ser Lys Ala Tyr Ser 55 60 65 70

Ala Leu Ile Glu Ala Ile Gln Lys Asn Ala Thr Ala Phe Lys Gly Lys 75 80 85

Tyr Ala Phe Leu Lys Thr Tyr Asn Tyr Thr Leu Gly Ala Asp Asp Leu 90 95 100

Thr Pro Phe Gly Glu Asn Gln Met Val Asn Ser Gly Ile Lys Phe Tyr 105 110 115

Arg Arg Tyr Lys Ala Leu Ala Arg Lys Ile Val Pro Phe Ile Arg Ala 120 125 130

Ser Gly Ser Asp Arg Val Ile Ala Ser Ala Glu Lys Phe Ile Glu Gly 145 Phe Gln Ser Ala Lys Leu Ala Asp Pro Gly Ser Gln Pro His Gln Ala 155 160 Ser Pro Val Ile Asp Val Ile Ile Pro Glu Gly Ser Gly Tyr Asn Asn Thr Leu Asp His Gly Thr Cys Thr Ala Phe Glu Asp Ser Glu Leu Gly 190 Asp Asp Val Glu Ala Asn Phe Thr Ala Leu Phe Ala Pro Ala Ile Arg 205 Ala Arg Leu Glu Ala Asp Leu Pro Gly Val Thr Leu Thr Asp Glu Asp 225 Val Val Tyr Leu Met Asp Met Cys Pro Phe Glu Thr Val Ala Arg Thr Ser Asp Ala Thr Glu Leu Ser Pro Phe Cys Ala Leu Phe Thr His Asp Glu Trp Arg Gln Tyr Asp Tyr Leu Gln Ser Leu Gly Lys Tyr Tyr Gly Tyr Gly Ala Gly Asn Pro Leu Gly Pro Ala Gln Gly Val Gly Phe Ala 280 285 Asn Glu Leu Ile Ala Arg Leu Thr Arg Ser Pro Val Gln Asp His Thr 300 Ser Thr Asn His Thr Leu Asp Ser Asn Pro Ala Thr Phe Pro Leu Asn 315 320 Ala Thr Leu Tyr Ala Asp Phe Ser His Asp Asn Ser Met Ile Ser Ile 330 335 Phe Phe Ala Leu Gly Leu Tyr Asn Gly Thr Ala Pro Leu Ser Thr Thr 350 Ser Val Glu Ser Ile Glu Glu Thr Asp Gly Tyr Ser Ala Ser Trp Thr 365 370 Val Pro Phe Gly Ala Arg Ala Tyr Val Glu Met Met Gln Cys Gln Ala

375

380

385

390

Glu Lys Glu Pro Leu Val Arg Val Leu Val Asn Asp Arg Val Val Pro 395 400 405

Leu His Gly Cys Ala Val Asp Lys Leu Gly Arg Cys Lys Arg Asp Asp 410 415 420

Phe Val Glu Gly Leu Ser Phe Ala Arg Ser Gly Gly Asn Trp Ala Glu 425 430 435

Cys Phe Ala

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<211> 422

<212> PRT

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<400> 17

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Gln Arg Asn Trp Ser Pro Tyr Ser Pro Tyr Phe Pro Leu Ala Glu Tyr 25 30

Lys Ala Pro Pro Ala Gly Cys Gln Ile Asn Gln Val Asn Ile Ile Gln 35 40 45

Arg His Gly Ala Arg Phe Pro Thr Ser Gly Ala Thr Thr Arg Ile Lys 50 55 60

Ala Gly Leu Thr Lys Leu Gln Gly Val Gln Asn Phe Thr Asp Ala Lys 70 75 80

Phe Asn Phe Ile Lys Ser Phe Lys Tyr Asp Leu Gly Asn Ser Asp Leu 85 90 95

Val Pro Phe Gly Ala Ala Gl
n Ser Phe Asp Ala Gly Gl
n Glu Ala Phe 100 \$100

Ala Arg Tyr Ser Lys Leu Val Ser Lys Asn Asn Leu Pro Phe Ile Arg

Ala Asp Gly Ser Asp Arg Val Val Asp Ser Ala Thr Asn Trp Thr Ala 130 135 140

Gly Phe Ala Ser Ala Ser His Asn Thr Val Gln Pro Lys Leu Asn Leu 155 Ile Leu Pro Gln Thr Gly Asn Asp Thr Leu Glu Asp Asn Met Cys Pro 175 Ala Ala Gly Asp Ser Asp Pro Gln Val Asn Ala Trp Leu Ala Val Ala 185 Phe Pro Ser Ile Thr Ala Arg Leu Asn Ala Ala Ala Pro Ser Val Asn 200 Leu Thr Asp Thr Asp Ala Phe Asn Leu Val Ser Leu Cys Ala Phe Leu 215 Thr Val Ser Lys Glu Lys Lys Ser Asp Phe Cys Thr Leu Phe Glu Gly Ile Pro Gly Ser Phe Glu Ala Phe Ala Tyr Gly Gly Asp Leu Asp Lys Phe Tyr Gly Thr Gly Tyr Gly Gln Glu Leu Gly Pro Val Gln Gly Val Gly Tyr Val Asn Glu Leu Ile Ala Arg Leu Thr Asn Ser Ala Val Arg 280 Asp Asn Thr Gln Thr Asn Arg Thr Leu Asp Ala Ser Pro Val Thr Phe 300 Pro Leu Asn Lys Thr Phe Tyr Ala Asp Phe Ser His Asp Asn Leu Met 310 315 Val Ala Val Phe Ser Ala Met Gly Leu Phe Arg Gln Pro Ala Pro Leu Ser Thr Ser Val Pro Asn Pro Trp Arg Thr Trp Arg Thr Ser Ser Leu 345 Val Pro Phe Ser Gly Arg Met Val Val Glu Arg Leu Ser Cys Phe Gly Thr Thr Lys Val Arg Val Leu Val Gln Asp Gln Val Gln Pro Leu Glu

Phe Cys Gly Gly Asp Arg Asn Gly Leu Cys Thr Leu Ala Lys Phe Val 390 395 400

Cys Phe Ala Thr Ser Ala 420

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<211> 422

<212> PRT

<213> Paxillus involutus phyA2

<400> 18

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. Gln Arg Asn Trp Ser Pro Tyr Ser Pro Tyr Phe Pro Leu Ala Glu Tyr 25 30

Lys Ala Pro Pro Ala Gly Cys Glu Ile Asn Gln Val Asn Ile Ile Gln 35 40 45

Arg His Gly Ala Arg Phe Pro Thr Ser Gly Ala Ala Thr Arg Ile Lys 50 55 60

Ala Gly Leu Ser Lys Leu Gln Ser Val Gln Asn Phe Thr Asp Pro Lys 75 80

Phe Asp Phe Ile Lys Ser Phe Thr Tyr Asp Leu Gly Thr Ser Asp Leu 85 90 95

Val Pro Phe Gly Ala Ala Gln Ser Phe Asp Ala Gly Leu Glu Val Phe 100 105 110

Ala Arg Tyr Ser Lys Leu Val Ser Ser Asp Asn Leu Pro Phe Ile Arg 115 120 125

Ser Asp Gly Ser Asp Arg Val Val Asp Thr Ala Thr Asn Trp Thr Ala 130 135 140

Gly Phe Ala Ser Ala Ser Arg Asn Ala Ile Gln Pro Lys Leu Asp Leu 145 155 1560

Ile Leu Pro Gln Thr Gly Asn Asp Thr Leu Glu Asp Asn Met Cys Pro 165 170 175

Ala Ala Gly Glu Ser Asp Pro Gln Val Asp Ala Trp Leu Ala Ser Ala Phe Pro Ser Val Thr Ala Gln Leu Asn Ala Ala Ala Pro Gly Ala Asn Leu Thr Asp Ala Asp Ala Phe Asn Leu Val Ser Leu Cys Pro Phe Met Thr Val Ser Lys Glu Gln Lys Ser Asp Phe Cys Thr Leu Phe Glu Gly 235 Ile Pro Gly Ser Phe Glu Ala Phe Ala Tyr Ala Gly Asp Leu Asp Lys Phe Tyr Gly Thr Gly Tyr Gly Gln Ala Leu Gly Pro Val Gln Gly Val Gly Tyr Ile Asn Glu Leu Leu Ala Arg Leu Thr Asn Ser Ala Val Asn Asp Asn Thr Gln Thr Asn Arg Thr Leu Asp Ala Ala Pro Asp Thr Phe Pro Leu Asn Lys Thr Met Tyr Ala Asp Phe Ser His Asp Asn Leu Met 315 Val Ala Val Phe Ser Ala Met Gly Leu Phe Arg Gln Ser Ala Pro Leu Ser Thr Ser Thr Pro Asp Pro Asn Arg Thr Trp Leu Thr Ser Ser Val 345 Val Pro Phe Ser Ala Arg Met Ala Val Glu Arg Leu Ser Cys Ala Gly Thr Thr Lys Val Arg Val Leu Val Gln Asp Gln Val Gln Pro Leu Glu Phe Cys Gly Gly Asp Gln Asp Gly Leu Cys Ala Leu Asp Lys Phe Val Glu Ser Gln Ala Tyr Ala Arg Ser Gly Gly Ala Gly Asp Phe Glu Lys 410

Cys Leu Ala Thr Thr Val 420 <210> 19 <211> 420 <212> PRT <213> Trametes Pubescens <400> 19 His Ile Pro Leu Arg Asp Thr Ser Ala Cys Leu Asp Val Thr Arg Asp Val Gln Gln Ser Trp Ser Met Tyr Ser Pro Tyr Phe Pro Ala Ala Thr Tyr Val Ala Pro Pro Ala Ser Cys Gln Ile Asn Gln Val His Ile Ile Gln Arg His Gly Ala Arg Phe Pro Thr Ser Gly Ala Ala Lys Arg Ile Gln Thr Ala Val Ala Lys Leu Lys Ala Ala Ser Asn Tyr Thr Asp Pro 70 Leu Leu Ala Phe Val Thr Asn Tyr Thr Tyr Ser Leu Gly Gln Asp Ser Leu Val Glu Leu Gly Ala Thr Gln Ser Ser Glu Ala Gly Gln Glu Ala Phe Thr Arg Tyr Ser Ser Leu Val Ser Ala Asp Glu Leu Pro Phe Val 120 Arg Ala Ser Gly Ser Asp Arg Val Val Ala Thr Ala Asn Asn Trp Thr 135 Ala Gly Phe Ala Leu Ala Ser Ser Asn Ser Ile Thr Pro Val Leu Ser 150 155 Val Ile Ile Ser Glu Ala Gly Asn Asp Thr Leu Asp Asp Asn Met Cys 170 Pro Ala Ala Gly Asp Ser Asp Pro Gln Val Asn Gln Trp Leu Ala Gln 185

Phe Ala Pro Pro Met Thr Ala Arg Leu Asn Ala Gly Ala Pro Gly Ala

200 205

Asn Leu Thr Asp Thr Asp Thr Tyr Asn Leu Leu Thr Leu Cys Pro Phe 210 220

Glu Thr Val Ala Thr Glu Arg Arg Ser Glu Phe Cys Asp Ile Tyr Glu 235 235 240

Glu Leu Gln Ala Glu Asp Ala Phe Ala Tyr Asn Ala Asp Leu Asp Lys 255

Phe Tyr Gly Thr Gly Tyr Gly Gln Pro Leu Gly Pro Val Gln Gly Val 260 265 270

Gly Tyr Ile Asn Glu Leu Ile Ala Arg Leu Thr Ala Gln Asn Val Ser 275 280 285

Asp His Thr Gln Thr Asn Ser Thr Leu Asp Ser Ser Pro Glu Thr Phe 290 295 300

Pro Leu Asn Arg Thr Leu Tyr Ala Asp Phe Ser His Asp Asn Gln Met 310 315 315

Val Ala Ile Phe Ser Ala Met Gly Leu Phe Asn Gln Ser Ala Pro Leu 325 330 335

Asp Pro Thr Thr Pro Asp Pro Ala Arg Thr Phe Leu Val Lys Lys Ile 340

Val Pro Phe Ser Ala Arg Met Val Val Glu Arg Leu Asp Cys Gly Gly 355 360 365

Ala Gln Ser Val Arg Leu Leu Val Asn Asp Ala Val Gln Pro Leu Ala 370 375 380

Phe Cys Gly Ala Asp Thr Ser Gly Val Cys Thr Leu Asp Ala Phe Val 385 395 400

Glu Ser Gln Ala Tyr Ala Arg Asn Asp Gly Glu Gly Asp Phe Glu Lys 405 410 415

Cys Phe Ala Thr 420

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Glu Thr Ile Val Lys Glu Thr Pro Ser Pro Phe Cys Asn Leu Phe Thr 225 Pro Glu Glu Phe Ala Gln Phe Glu Tyr Phe Gly Asp Leu Asp Lys Phe Tyr Gly Thr Gly Tyr Gly Gln Pro Leu Gly Pro Val Gln Gly Val Gly 260 Tyr Ile Asn Glu Leu Leu Ala Arg Leu Thr Glu Met Pro Val Arg Asp 280 Asn Thr Gln Thr Asn Arg Thr Leu Asp Ser Ser Pro Leu Thr Phe Pro 295 Leu Asp Arg Ser Ile Tyr Ala Asp Leu Ser His Asp Asn Gln Met Ile 310 315 Ala Ile Phe Ser Ala Met Gly Leu Phe Asn Gln Ser Ser Pro Leu Asp 330 Pro Ser Phe Pro Asn Pro Lys Arg Thr Trp Val Thr Ser Arg Leu Thr 345 Pro Phe Ser Ala Arg Met Val Thr Glu Arg Leu Leu Cys Gln Arg Asp 360 365 Gly Thr Gly Ser Gly Gly Pro Ser Arg Ile Met Arg Asn Gly Asn Val Gln Thr Phe Val Arg Ile Leu Val Asn Asp Ala Leu Gln Pro Leu Lys 385 390 395 Phe Cys Gly Gly Asp Met Asp Ser Leu Cys Thr Leu Glu Ala Phe Val 405 Glu Ser Gln Lys Tyr Ala Arg Glu Asp Gly Gln Gly Asp Phe Glu Lys 420 Cys Phe Asp 435 <210> 21 <211> 419 <212> PRT <213> Peniophora lycii

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230

Glu Glu Tyr Val Ser Tyr Glu Tyr Tyr Tyr Asp Leu Asp Lys Tyr Tyr 250 Gly Thr Gly Pro Gly Asn Ala Leu Gly Pro Val Gln Gly Val Gly Tyr Val Asn Glu Leu Leu Ala Arg Leu Thr Gly Gln Ala Val Arg Asp Glu 280 Thr Gln Thr Asn Arg Thr Leu Asp Ser Asp Pro Ala Thr Phe Pro Leu Asn Arg Thr Phe Tyr Ala Asp Phe Ser His Asp Asn Thr Met Val Pro 310 315 320 Ile Phe Ala Ala Leu Gly Leu Phe Asn Ala Thr Ala Leu Asp Pro Leu 325 330 335 Lys Pro Asp Glu Asn Arg Leu Trp Val Asp Ser Lys Leu Val Pro Phe 340 345 Ser Gly His Met Thr Val Glu Lys Leu Ala Cys Ser Gly Lys Glu Ala 360 365 Val Arg Val Leu Val Asn Asp Ala Val Gln Pro Leu Glu Phe Cys Gly 375 Gly Val Asp Gly Val Cys Glu Leu Ser Ala Phe Val Glu Ser Gln Thr 390 395 Tyr Ala Arg Glu Asn Gly Gln Gly Asp Phe Ala Lys Cys Gly Phe Val Pro Ser Glu <210> 22 <211> 369 <212> PRT <213> Peniophora lycii <400> 22 Ser Pro Arg Thr Ala Ala Gln Leu Pro Ile Pro Gln Gln Trp Ser Pro 5 Tyr Ser Pro Tyr Phe Pro Val Ala Tyr Ala Pro Pro Ala Gly Cys Gln

20

25

30

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- Gly Ala Ala Thr Arg Ile Gln Ala Ala Val Ala Lys Leu Gln Ser Ala 50 55 60
- Thr Asp Pro Lys Leu Asp Phe Leu Asn Thr Tyr Leu Gly Asp Asp Leu 65 70 75 80
- Val Pro Phe Gly Ala Gln Ser Ser Gln Ala Gly Gln Glu Ala Phe Thr 85 90 95
- Arg Tyr Ser Leu Val Ser Asp Asn Leu Pro Phe Val Arg Ala Ser Gly
- Ser Asp Arg Val Val Asp Ser Ala Thr Asn Trp Thr Ala Gly Phe Ala 115 120 125
- Ala Ser Asn Thr Pro Leu Val Ile Leu Ser Glu Gly Asn Asp Thr Leu 130 135 140
- Asp Asp Asn Met Cys Pro Ala Gly Asp Ser Asp Pro Gln Asn Trp Leu 145 150 155 160
- Ala Val Phe Ala Pro Pro Ile Thr Ala Arg Leu Asn Ala Ala Ala Pro 165 170 175
- Gly Ala Asn Leu Thr Asp Asp Ala Asn Leu Leu Cys Pro Phe Glu Thr 180 185 190
- Val Ser Glu Ser Phe Cys Asp Leu Phe Glu Pro Glu Glu Phe Ala Phe
 195 200 205
- Tyr Gly Asp Leu Asp Lys Phe Tyr Gly Thr Gly Tyr Gly Gln Pro Leu 210 215
- Gly Pro Val Gln Gly Val Gly Tyr Ile Asn Glu Leu Leu Ala Arg Leu 225 230 235 240
- Thr Gln Ala Val Arg Asp Asn Thr Gln Thr Asn Arg Thr Leu Asp Ser 245 250 255
- Ser Pro Thr Phe Pro Leu Asn Arg Thr Phe Tyr Ala Asp Phe Ser His 260 265 270

Asp Asn Gln Met Val Ala Ile Phe Ser Ala Met Gly Leu Phe Asn Gln 275 Ser Ala Pro Leu Asp Pro Ser Pro Asp Pro Asn Arg Thr Trp Val Thr 290 Ser Lys Leu Val Pro Phe Ser Ala Arg Met Val Val Glu Arg Leu Cys 305 315 Gly Thr Val Arg Val Leu Val Asn Asp Ala Val Gln Pro Leu Glu Phe 330 Cys Gly Gly Asp Asp Gly Cys Thr Leu Asp Ala Phe Val Glu Ser Gln Tyr Ala Arg Glu Asp Gly Gln Gly Asp Phe Glu Lys Cys Phe Ala Thr Pro <210> 23 <211> 440 <212> PRT <213> Thermomyces lanuginosus <400> 23 Asn Val Asp Ile Ala Arg His Trp Gly Gln Tyr Ser Pro Phe Phe Ser 5 10 Leu Ala Glu Val Ser Glu Ile Ser Pro Ala Val Pro Lys Gly Cys Arg 20 25 Val Glu Phe Val Gln Val Leu Ser Arg His Gly Ala Arg Tyr Pro Thr 35 40 Ala His Lys Ser Glu Val Tyr Ala Glu Leu Leu Gln Arg Ile Gln Asp 55 Thr Ala Thr Glu Phe Lys Gly Asp Phe Ala Phe Leu Arg Asp Tyr Ala 70 Tyr His Leu Gly Ala Asp Asn Leu Thr Arg Phe Gly Glu Glu Gln Met

Met Glu Ser Gly Arg Gln Phe Tyr His Arg Tyr Arg Glu Gln Ala Arg 105 Glu Ile Val Pro Phe Val Arg Ala Ala Gly Ser Ala Arg Val Ile Ala 115 120 Ser Ala Glu Phe Phe Asn Arg Gly Phe Gln Asp Ala Lys Asp Arg Asp 135 140 Pro Arg Ser Asn Lys Asp Gln Ala Glu Pro Val Ile Asn Val Ile Ile 150 155 Ser Glu Glu Thr Gly Ser Asn Asn Thr Leu Asp Gly Leu Thr Cys Pro 170 Ala Ala Glu Glu Ala Pro Asp Pro Thr Gln Pro Ala Glu Phe Leu Gln 185 Val Phe Gly Pro Arg Val Leu Lys Lys Ile Thr Lys His Met Pro Gly 200 Val Asn Leu Thr Leu Glu Asp Val Pro Leu Phe Met Asp Leu Cys Pro Phe Asp Thr Val Gly Ser Asp Pro Val Leu Phe Pro Arg Gln Leu Ser 230 Pro Phe Cys His Leu Phe Thr Ala Asp Asp Trp Met Ala Tyr Asp Tyr Tyr Tyr Thr Leu Asp Lys Tyr Tyr Ser His Gly Gly Ser Ala Phe 265 Gly Pro Ser Arg Gly Val Gly Phe Val Asn Glu Leu Ile Ala Arg Met 280 285 Thr Gly Asn Leu Pro Val Lys Asp His Thr Thr Val Asn His Thr Leu 295 300 Asp Asp Asn Pro Glu Thr Phe Pro Leu Asp Ala Val Leu Tyr Ala Asp 310 315 Phe Ser His Asp Asn Thr Met Thr Gly Ile Phe Ser Ala Met Gly Leu 325 330 335 Tyr Asn Gly Thr Lys Pro Leu Ser Thr Ser Lys Ile Gln Pro Pro Thr

340 345

350

Gly Ala Ala Asp Gly Tyr Ala Ala Ser Trp Thr Val Pro Phe Ala 355 360 365

Ala Arg Ala Tyr Val Glu Leu Leu Arg Cys Glu Thr Glu Thr Ser Ser 370 375 380

Glu Glu Glu Glu Glu Gly Glu Asp Glu Pro Phe Val Arg Val Leu Val 385 390 395 400

Asn Asp Arg Val Val Pro Leu His Gly Cys Arg Val Asp Arg Trp Gly 405 410 415

Arg Cys Arg Arg Asp Glu Trp Ile Lys Gly Leu Thr Phe Ala Arg Gln 420 425 430

Gly Gly His Trp Asp Arg Cys Phe 435 440

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<212> PRT

<213> Artificial Sequence

<220>

<223> Synthetic

<400> 24

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Glu Ile Ser His Leu Trp Gly Gln Tyr Ser Pro Phe Phe Ser Leu Ala 20 25 30

Asp Glu Ser Ala Ile Ser Pro Asp Val Pro Lys Gly Cys Arg Val Thr 35 40 45

Phe Val Gln Val Leu Ser Arg His Gly Ala Arg Tyr Pro Thr Ser Ser 50 55 60

Lys Ser Lys Lys Tyr Ser Ala Leu Ile Glu Ala Ile Gln Lys Asn Ala 70 75

Thr Ala Phe Lys Gly Lys Tyr Ala Phe Leu Lys Thr Tyr Asn Tyr Thr 85 90 95

Leu Gly Ala Asp Asp Leu Thr Pro Phe Gly Glu Gln Met Val Asn 100 105 Ser Gly Ile Lys Phe Tyr Arg Arg Tyr Lys Ala Leu Ala Arg Lys Ile 115 120 Val Pro Phe Val Arg Ala Ser Gly Ser Asp Arg Val Ile Ala Ser Ala 130 Glu Lys Phe Ile Glu Gly Phe Gln Ser Ala Lys Leu Ala Asp Pro Gly 145 150 Ala Asn Pro His Gln Ala Ser Pro Val Ile Asn Val Ile Ile Pro Glu 170 Gly Ala Gly Tyr Asn Asn Thr Leu Asp His Gly Leu Cys Thr Ala Phe 185 Glu Glu Ser Glu Leu Gly Asp Asp Val Glu Ala Asn Phe Thr Ala Val 200 205 Phe Ala Pro Pro Ile Arg Ala Arg Leu Glu Ala His Leu Pro Gly Val Asn Leu Thr Asp Glu Asp Val Val Asn Leu Met Asp Met Cys Pro Phe 235 Asp Thr Val Ala Arg Thr Ser Asp Ala Thr Gln Leu Ser Pro Phe Cys 245 250 Asp Leu Phe Thr His Asp Glu Trp Ile Gln Tyr Asp Tyr Leu Gln Ser 265 Leu Gly Lys Tyr Tyr Gly Tyr Gly Ala Gly Asn Pro Leu Gly Pro Ala 280 Gln Gly Val Gly Phe Val Asn Glu Leu Ile Ala Arg Leu Thr His Ser 290 295 300 Pro Val Gln Asp His Thr Ser Thr Asn His Thr Leu Asp Ser Asn Pro 310 315 320 Ala Thr Phe Pro Leu Asn Ala Thr Leu Tyr Ala Asp Phe Ser His Asp 325 330 335 Asn Thr Met Val Ser Ile Phe Phe Ala Leu Gly Leu Tyr Asn Gly Thr

340 345 350

Tyr Ala Ala Ser Trp Thr Val Pro Phe Ala Ala Arg Ala Tyr Val Glu 370 375 380

Met Met Gln Cys Glu Ala Glu Lys Glu Pro Leu Val Arg Val Leu Val 385 390 395 400

Asn Asp Arg Val Val Pro Leu His Gly Cys Gly Val Asp Lys Leu Gly 405

Arg Cys Lys Arg Asp Asp Phe Val Glu Gly Leu Ser Phe Ala Arg Ser 420 425 430

Gly Gly Asn Trp Glu Glu Cys Phe Ala 435 440

<210> 25

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<220>

<221> sig_peptide

 $\langle 222 \rangle$ (12)...(89)

<223>

<400> 25

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Met Gly Val Phe Val Val Leu Leu Ser Ile Ala Thr Leu

-25

-15

ttc ggt tcc aca tcc ggt acc gcc ttg ggt cct cgt ggt aat tct cac Phe Gly Ser Thr Ser Gly Thr Ala Leu Gly Pro Arg Gly Asn Ser His -10 -5 -1 1

98

tct tgt gac act gtt gac ggt ggt tac caa tgt ttc cca gaa att tct Ser Cys Asp Thr Val Asp Gly Gly Tyr Gln Cys Phe Pro Glu Ile Ser 5 10 15	146
cac ttg tgg ggt caa tac tct cca ttc ttc tct ttg gct gac gaa tct His Leu Trp Gly Gln Tyr Ser Pro Phe Phe Ser Leu Ala Asp Glu Ser 20 25 30 35	194
gct att tct cca gac gtt cca aag ggt tgt aga gtt act ttc gtt caa Ala Ile Ser Pro Asp Val Pro Lys Gly Cys Arg Val Thr Phe Val Gln 40 45 50	242
gtt ttg tct aga cac ggt gct aga tac cca act tct tct aag tct aag Val Leu Ser Arg His Gly Ala Arg Tyr Pro Thr Ser Ser Lys Ser Lys 55 60 65	290
aag tac tct gct ttg att gaa gct att caa aag aac gct act gct ttc Lys Tyr Ser Ala Leu Ile Glu Ala Ile Gln Lys Asn Ala Thr Ala Phe 70 75 80	338
aag ggt aag tac gct ttc ttg aag act tac aac tac act ttg ggt gct Lys Gly Lys Tyr Ala Phe Leu Lys Thr Tyr Asn Tyr Thr Leu Gly Ala 85 90 95	386
gac gac ttg act cca ttc ggt gaa caa caa atg gtt aac tct ggt att Asp Asp Leu Thr Pro Phe Gly Glu Gln Gln Met Val Asn Ser Gly Ile 100 115	434
aag ttc tac aga aga tac aag gct ttg gct aga aag att gtt cca ttc Lys Phe Tyr Arg Arg Tyr Lys Ala Leu Ala Arg Lys Ile Val Pro Phe 120 125 130	482
gtt aga gct tct ggt tct gac aga gtt att gct tct gct gaa aag ttc Val Arg Ala Ser Gly Ser Asp Arg Val Ile Ala Ser Ala Glu Lys Phe 135 140 145	530
att gaa ggt ttc caa tct gct aag ttg gct gac cca ggt gct aac cca Ile Glu Gly Phe Gln Ser Ala Lys Leu Ala Asp Pro Gly Ala Asn Pro 150 160	578
cac caa gct tct cca gtt att aac gtt att att cca gaa ggt gct ggt His Gln Ala Ser Pro Val Ile Asn Val Ile Ile Pro Glu Gly Ala Gly 165 170 175	626
tac aac act ttg gac cac ggt ttg tgt act gct ttc gaa gaa tct Tyr Asn Asn Thr Leu Asp His Gly Leu Cys Thr Ala Phe Glu Glu Ser 180 185 190 195	674
gaa ttg ggt gac gac gtt gaa gct aac ttc act gct gtt ttc gct cca Glu Leu Gly Asp Asp Val Glu Ala Asn Phe Thr Ala Val Phe Ala Pro 200 205 210	722
cct att aga gct aga ttg gaa gct cac ttg cca ggt gtt aac ttg act Pro Ile Arg Ala Arg Leu Glu Ala His Leu Pro Gly Val Asn Leu Thr 215 220 225	770
gac gaa gac gtt gtt aac ttg atg gac atg tgt cca ttc gac act gtt Asp Glu Asp Val Val Asn Leu Met Asp Met Cys Pro Phe Asp Thr Val 230 235 240	818

gc [.]	t aga a Arc 245	J 111-	t tot r Sei	c gad	c gct o Ala	t act a Thi 250	: Gli	a tto n Lei	tc: Se:	t cc.	a tto o Pho 25!	е Су	t gad s Asp	c tt p Le	g ttc u Phe	866
act Thi 260	L 11TS	gad S Asp	c gaa o Glu	a tgg ı Trp	g att D Ile 265	e Gir	ı tad	gac Asp	tao Tyi	c tto r Lei 270	ي Glr	a to n Sei	tto Lei	g gg Gl	t aag y Lys 275	914
tac Tyr	tac Tyr	: ggt	tac Tyr	ggt Gly 280	ATa	ggt Gly	aac Asr	cca Pro	tto Lei 285	ı Gly	cca Pro	a gct o Ala	caa Glr	ggt Gly 290	t gtt y Val)	962
ggt Gly	ttc Phe	gtt Val	aac Asn 295	GIU	ttg Leu	g att Ile	gct Ala	aga Arg 300	ttg Lev	g act ı Thr	cac His	tct Ser	cca Pro	Va]	caa Gln	1010
gac Asp	cac His	act Thr 310	Det	act Thr	aac Asn	cac His	act Thr 315	ьeu	gac Asp	tct Ser	aac Asn	cca Pro 320	Ala	act Thr	ttc Phe	1058
cca Pro	ttg Leu 325	aac Asn	gct Ala	act Thr	ttg Leu	tac Tyr 330	gct Ala	gac Asp	ttc Phe	tct Ser	cac His 335	Asp	aac Asn	act Thr	atg Met	1106
gtt Val 340	Set	att Ile	ttc Phe	ttc Phe	gct Ala 345	ttg Leu	ggt Gly	ttg Leu	tac Tyr	aac Asn 350	ggt Gly	act Thr	aag Lys	cca Pro	ttg Leu 355	1154
tct Ser	act Thr	act Thr	tct Ser	gtt Val 360	gaa Glu	tct Ser	att Iʻle	gaa Glu	gaa Glu 365	act Thr	gac Asp	ggt Gly	tac Tyr	gct Ala 370	gct Ala	1202
tct Ser	tgg Trp	act Thr	gtt Val 375	cca Pro	ttc Phe	gct Ala	gct Ala	aga Arg 380	gct Ala	tac Tyr	gtt Val	gaa Glu	atg Met 385	atg Met	caa Gln	1250
tgt Cys	gaa Glu	gct Ala 390	gaa Glu	aag Lys	gaa Glu	cca Pro	ttg Leu 395	gtt Val	aga Arg	gtt Val	ttg Leu	gtt Val 400	aac Asn	gac Asp	aga Arg	1298
gtt Val	gtt Val 405	cca Pro	ttg Leu	cac His	ggt Gly	tgt Cys 410	ggt Gly	gtt Val	gac Asp	aag Lys	ttg Leu 415	ggt Gly	aga Arg	tgt Cys	aag Lys	1346
aga Arg 420	gac Asp	gac Asp	ttc Phe	var	gaa Glu 425	ggt Gly	ttg Leu	tct Ser	ttc Phe	gct Ala 430	aga Arg	tct Ser	ggt Gly	ggt Gly	aac Asn 435	1394
tgg Trp	gaa Glu	gaa Glu	Cys	ttc Phe . 440	gct Ala	taag	aatt	ca t	ata							1426
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<220: <223:	>		etic													

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Asp Asp Val Glu Ala Asn Phe Thr Ala Val Phe Ala Pro Pro Ile Arg

205

200

Ala Arg Leu Glu Ala His Leu Pro Gly Val Asn Leu Thr Asp Glu Asp Val Val Asn Leu Met Asp Met Cys Pro Phe Asp Thr Val Ala Arg Thr Ser Asp Ala Thr Gln Leu Ser Pro Phe Cys Asp Leu Phe Thr His Asp Glu Trp Ile Gln Tyr Asp Tyr Leu Gln Ser Leu Gly Lys Tyr Tyr Gly 270 Tyr Gly Ala Gly Asn Pro Leu Gly Pro Ala Gln Gly Val Gly Phe Val 285 Asn Glu Leu Ile Ala Arg Leu Thr His Ser Pro Val Gln Asp His Thr 300 310 Ser Thr Asn His Thr Leu Asp Ser Asn Pro Ala Thr Phe Pro Leu Asn 315 320 325 Ala Thr Leu Tyr Ala Asp Phe Ser His Asp Asn Thr Met Val Ser Ile 330 335 340 Phe Phe Ala Leu Gly Leu Tyr Asn Gly Thr Lys Pro Leu Ser Thr Thr 345 350 Ser Val Glu Ser Ile Glu Glu Thr Asp Gly Tyr Ala Ala Ser Trp Thr 360 Val Pro Phe Ala Ala Arg Ala Tyr Val Glu Met Met Gln Cys Glu Ala 375 380 Glu Lys Glu Pro Leu Val Arg Val Leu Val Asn Asp Arg Val Val Pro 395 Leu His Gly Cys Gly Val Asp Lys Leu Gly Arg Cys Lys Arg Asp Asp 410 Phe Val Glu Gly Leu Ser Phe Ala Arg Ser Gly Gly Asn Trp Glu Glu 425 Cys Phe Ala 440

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<220> <223> Synthetic
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Ser His Leu Trp Gly Gln Tyr Ser Pro Phe Phe Ser Leu Ala Asp Glu 20 25 30
Ser Ala Ile Ser Pro Asp Val Pro Lys Gly Cys Arg Val Thr Phe Val 35 40 45
Gln Val Leu Ser Arg His Gly Ala Arg Tyr Pro Thr Ser Ser Lys Ser 50 60
Lys Lys Tyr Ser Ala Leu Ile Glu Arg Ile Gln Lys Asn Ala Thr Phe 70 75 80
Lys Gly Lys Tyr Ala Phe Leu Lys Thr Tyr Asn Tyr Thr Leu Gly Ala 85 90 95
Asp Asp Leu Thr Pro Phe Gly Glu Asn Gln Met Val Asn Ser Gly Ile 100 105 110
Lys Phe Tyr Arg Arg Tyr Lys Ala Leu Ala Arg Asn Ile Val Pro Phe 115 120 125
Val Arg Ala Ser Gly Ser Asp Arg Val Ile Ala Ser Ala Glu Lys Phe 130 135 140
Ile Glu Gly Phe Gln Ser Ala Lys Leu Ala Asp Pro Ala His Gln Ala 145 150 155 160
Ser Pro Val Ile Asn Val Ile Ile Pro Glu Gly Ser Gly Tyr Asn Asn 165 170 175
Thr Leu Asp His Gly Leu Cys Thr Ala Phe Glu Asp Ser Thr Leu Gly 180 185 190
Asp Asp Ala Glu Ala Asn Phe Thr Ala Val Phe Ala Pro Pro Ile Arg

Ala Arg Leu Glu Ala Leu Pro Gly Val Asn Leu Thr Asp Glu Asp Val 215 Val Asn Leu Met Asp Met Cys Pro Phe Asp Thr Val Ala Arg Thr Ser Asp Ala Thr Gln Leu Ser Pro Phe Cys Asp Leu Phe Thr Ala Asp Glu Trp Gln Tyr Asp Tyr Leu Gln Ser Leu Lys Tyr Tyr Gly Tyr Gly Ala Gly Asn Pro Leu Gly Pro Ala Gln Gly Val Gly Phe Asn Glu Leu Ile 280 Ala Arg Leu Thr His Ser Pro Val Gln Asp His Thr Ser Thr Asn His 295 300 Thr Leu Asp Ser Asn Pro Ala Thr Phe Pro Leu Asn Ala Thr Leu Tyr 305 310 315 320 Ala Asp Phe Ser His Asp Asn Thr Met Val Ser Ile Phe Phe Ala Leu 325 330 335 Gly Leu Tyr Asn Gly Thr Lys Pro Leu Ser Thr Thr Ser Val Glu Ser 340 Ile Glu Thr Asp Gly Tyr Ala Ala Ser Trp Thr Val Pro Phe Ala Ala 360 Arg Ala Tyr Val Glu Met Met Gln Cys Glu Ala Gly Gly Gly Gly 370 Glu Gly Glu Lys Glu Pro Leu Val Arg Val Leu Val Asn Asp Arg Val 385 390 Val Pro Leu His Gly Cys Gly Val Asp Lys Leu Gly Arg Cys Lys Leu 405 Asp Asp Phe Val Glu Gly Leu Ser Phe Ala Arg Ser Gly Gly Asn Trp 420 Ala Glu Cys Phe Ala 435

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aca too ggt acc gcc ttg ggt cct cgt ggt aat tot cac tot tgt gac Thr Ser Gly Thr Ala Leu Gly Pro Arg Gly Asn Ser His Ser Cys Asp -10 -5 -1 1 5	96
act gtt gac ggt ggt tac caa tgt ttc cca gaa att tct cac ttg tgg Thr Val Asp Gly Gly Tyr Gln Cys Phe Pro Glu Ile Ser His Leu Trp 10 15 20	144
ggt acc tac tct cca tac ttc tct ttg gca gac gaa tct gct att tct Gly Thr Tyr Ser Pro Tyr Phe Ser Leu Ala Asp Glu Ser Ala Ile Ser 25 30 35	192
cca gac gtt cca gac gac tgt aga gtt act ttc gtt caa gtt ttg tct Pro Asp Val Pro Asp Asp Cys Arg Val Thr Phe Val Gln Val Leu Ser 40 45 50	240
aga cac ggt gct aga tac cca act tct tct gcg tct aag gct tac tct Arg His Gly Ala Arg Tyr Pro Thr Ser Ser Ala Ser Lys Ala Tyr Ser 55 60 65 70	288
gct ttg att gaa gct att caa aag aac gct act gct ttc aag ggt aag Ala Leu Ile Glu Ala Ile Gln Lys Asn Ala Thr Ala Phe Lys Gly Lys 75 80 85	336
tac gct ttc ttg aag act tac aac tac act ttg ggt gct gac gac ttg Tyr Ala Phe Leu Lys Thr Tyr Asn Tyr Thr Leu Gly Ala Asp Asp Leu 90 95 100	384
act cca ttc ggt gaa aac caa atg gtt aac tct ggt att aag ttc tac Thr Pro Phe Gly Glu Asn Gln Met Val Asn Ser Gly Ile Lys Phe Tyr	432

aga Arc	a aga g Ara 120	a - 7.	c aa r Ly	g gc s Al	t tt a Le	g gc u Al 12	a Ar	a aa g Ly	g at s Il	t gt e Va	al P	ca t ro P 30	tc	att Ile	ag Ar	a gct g Ala	:	480
135			1 110	b vr	14	0	e AI	a se	r Al	a G1 14	u L <u>y</u> 5	ys P	he	Il∈	e Gl	a ggt u Gly 150		528
				15.	5	u AI	a AS	o Pro	16	у Se О	r Gl	n P	ro	His	G1: 16			576
		, va.	170)	ı val	r TT(3 116	175	o GI	u GI	y S∈	er Gl	ly'	Гуг 180	Ası	c aac n Asn		624
	200	185	5	, Gi	7 1111	. Cys	190)	ı Phe	e GI	u As	p Se	er (95	Glu	Lei	a ggt 1 Gly	ı	672
1.00	200	Val	. GIU	ALC	i Asn	205	rnr	. Ala	. Lei	ı Phe	e Al 21	a Pr O	:0 F	lla	Il€	aga e Arg	-	720
215	9	Dea	Olu	. Ala	220	тeu	Pro	сту	val	. Thi	. Le	u Th	r A	sp	Glu	gac Asp 230	7	68
gtt Val	gtt Val	tac Tyr	ttg Leu	atg Met 235	ASP	atg Met	tgt Cys	cca Pro	ttc Phe 240	Asp	ac Th:	t gt r Va	c g l A	ct la	aga Arg 245	act Thr	8	16
tct Ser	gac Asp	gct Ala	act Thr 250	gaa Glu	ttg Leu	tct Ser	cca Pro	ttc Phe 255	tgt Cys	gct Ala	tto Lei	g tt 1 Ph	e T	ct hr 60	cac His	gac Asp	8	64
gaa Glu	tgg Trp	atc Ile 265	caa Gln	tac Tyr	gac Asp	tac Tyr	ttg Leu 270	caa Gln	agc Ser	ttg Leu	ggt Gly	aa Ly: 27	s T	ac yr	tac Tyr	ggt Gly	9	12
tac Tyr	ggt Gly 280	gct Ala	ggt Gly	aac Asn	cca Pro	ttg Leu 285	ggt Gly	cca Pro	gct Ala	caa Gln	ggt Gly 290	Va.	t go	gt ly	ttc Phe	gct Ala	9	60
aac (Asn (295	gaa Glu	ttg Leu	att Ile	gct Ala	aga Arg 300	ttg Leu	act Thr	cac His	tct Ser	cca Pro 305	gtt Val	caa Glr	aga n As	ac sp	cac His	act Thr 310	100	08
tct a Ser 1	act Thr .	aac Asn	cac His	act Thr 315	ttg Leu	gac Asp	tct Ser	aac Asn	cca Pro 320	gct Ala	act Thr	ttc Phe	c co Pr	0	ttg Leu 325	aac Asn	105	56
gct a Ala T	hr :	L-Cu	tac Tyr 330	gct Ala	gac Asp	ttc Phe	ser	cac His 335	gac Asp	aac Asn	act Thr	atg Met	at I1 34	.e S	ct Ser	att Ile	110)4
ttc t Phe P	ne r	gct Ala 345	ttg Leu	ggt Gly	ttg Leu	Tyr	aac Asn 350	ggt . Gly '	acc Thr	aag Lys	cca Pro	ttg Leu 355	tc Se	t a r T	ict 'hr	act Thr	115	2

Sei	t gtt r Val 360	r GTf	a tct 1 Ser	att Ile	gaa Glu	gaa Glu 365	Thr	gac Asp	ggt Gly	tac Tyr	tct Ser 370	: Ala	tct Ser	tgg Trp	g act Thr	1200
gtt Val 375	r Pro	tto Phe	gct Ala	gct Ala	aga Arg 380	gct Ala	tac Tyr	gtt Val	gaa Glu	atg Met 385	Met	caa Gln	tgt Cys	caa Gln	gct Ala 390	1248
gaa Glu	a aaq ı Lys	g gaa Glu	cca Pro	ttg Leu 395	Val	aga Arg	gtt Val	ttg Leu	gtt Val 400	Asn	gac Asp	aga Arg	gtt Val	gtt Val 405	cca Pro	1296
ttg Lev	g cac His	ggt Gly	tgt Cys 410	gct Ala	gtt Val	gac Asp	aag Lys	ttg Leu 415	Gly	aga Arg	tgt Cys	aag Lys	aga Arg 420	Asp	gac Asp	1344
ttc Phe	gtt Val	gaa Glu 425	GTÀ	ttg Leu	tct Ser	ttc Phe	gct Ala 430	aga Arg	tct Ser	ggt Gly	ggt Gly	aac Asn 435	tgg Trp	gct Ala	gaa Glu	1392
		gct Ala														1404
	1> 2>	29 467 PRT Arti	ficia	al Se	equer	nce										
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	3>	Syntl 29	hetio	2												
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75 80 85

Tyr	Ala	Phe	Leu 90	Lys	Thr	Tyr	Asn	Tyr 95	Thr	Leu	Gly	Ala	Asp 100	Asp	Leu

Thr Pro Phe Gly Glu Asn Gln Met Val Asn Ser Gly Ile Lys Phe Tyr 105 110 115

Arg Arg Tyr Lys Ala Leu Ala Arg Lys Ile Val Pro Phe Ile Arg Ala 120 125 130

Ser Gly Ser Asp Arg Val Ile Ala Ser Ala Glu Lys Phe Ile Glu Gly 140 145 150

Phe Gln Ser Ala Lys Leu Ala Asp Pro Gly Ser Gln Pro His Gln Ala 155 160 165

Ser Pro Val Ile Asn Val Ile Ile Pro Glu Gly Ser Gly Tyr Asn Asn 170 175 180

Thr Leu Asp His Gly Thr Cys Thr Ala Phe Glu Asp Ser Glu Leu Gly 185 190 195

Asp Asp Val Glu Ala Asn Phe Thr Ala Leu Phe Ala Pro Ala Ile Arg 200 205 210

Ala Arg Leu Glu Ala Asp Leu Pro Gly Val Thr Leu Thr Asp Glu Asp 215 220 225 230

Val Val Tyr Leu Met Asp Met Cys Pro Phe Asp Thr Val Ala Arg Thr 235 240 245

Ser Asp Ala Thr Glu Leu Ser Pro Phe Cys Ala Leu Phe Thr His Asp 250 255 260

. Glu Trp Ile Gln Tyr Asp Tyr Leu Gln Ser Leu Gly Lys Tyr Tyr Gly $265 \hspace{1cm} 270 \hspace{1cm} 275$

Tyr Gly Ala Gly Asn Pro Leu Gly Pro Ala Gln Gly Val Gly Phe Ala 280 285 290

Asn Glu Leu Ile Ala Arg Leu Thr His Ser Pro Val Gln Asp His Thr 300 305 310

Ser Thr Asn His Thr Leu Asp Ser Asn Pro Ala Thr Phe Pro Leu Asn 315 320 325

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act Thr	gtt Val	gac Asp	ggt Gly 10	ggt Gly	tac Tyr	caa Gln	tgt Cys	ttc Phe 15	cca Pro	gaa Glu	att Ile	tct Ser	cac His 20	ttg Leu	tgg Trp	144
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ttc t Phe P																1152
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Arg 55	His	Gly	Ala	Arg	Tyr 60	Pro	Thr	Ser	Ser	Ala 65	Ser	Lys	Ala	Tyr	Ser 70	/
Ala	Leu	lle	Glų	Ala 75	Ile	Glņ	ГÀг	Asn	Ala 80	Thŗ	Ala	Phe	Ly.s	Gly 85	Lys	./
Tyr	Ala	Pḥe	Leu 90	Lys	Tḥr	Tyr	Asn	Tyr 95	Thr	Leu	Gly		Asp 100	Asp	Leu	/
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Asp	Thr	Val 1	Asp I 10	ieu (Gly	Tyr	Gln	Cys 15	Ser	Pro	Ala	Thr	Ser 20	His	Leu	
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Asn Glu Leu Ile Ala Arg Leu Thr Arg Ser Pro Val Gln Asp His Thr 300 Ser Thr Asn Ser Thr Leu Val Ser Asn Pro Ala Thr Phe Pro Leu Asn 320 Ala Thr Met Tyr Val Asp Phe Ser His Asp Asn Ser Met Val Ser Ile 335 Phe Phe Ala Leu Gly Leu Tyr Asn Gly Thr Glu Pro Leu Ser Arg Thr 350 Ser Val Glu Ser Ala Lys Glu Leu Asp Gly Tyr Ser Ala Ser Trp Val 360 Val Pro Phe Gly Ala Arg Ala Tyr Phe Glu Thr Met Gln Cys Lys Ser 375 Glu Lys Glu Pro Leu Val Arg Ala Leu Ile Asn Asp Arg Val Val Pro 395 400 Leu His Gly Cys Asp Val Asp Lys Leu Gly Arg Cys Lys Leu Asn Asp 410 Phe Val Lys Gly Leu Ser Trp Ala Arg Ser Gly Gly Asn Trp Gly Glu 425 430 Cys Phe Ser 440 <210> 34 <211> 1426 <212> DNA <213> Artificial Sequence <220> <223> synthetic <220> <221> CDS <222> (12)..(1412) <223> <220> <221> mat_peptide <222> (90)..() <223>

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					aga Arg 300					1010
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Gly Gln Tyr Ser Pro Tyr Phe Ser Leu Glu Asp Glu Ser Ala Ile Ser 25 30 35

Pro Asp Val Pro Asp Asp Cys Arg Val Thr Phe Val Gln Val Leu Ser 40 45 50

Arg His Gly Ala Arg Tyr Pro Thr Asp Ser Lys Gly Lys Lys Tyr Ser 55 60 65 70

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Tyr Ala Phe Leu Lys Thr Tyr Asn Tyr Thr Leu Gly Ala Asp Asp Leu 90 95 100

Thr Pro Phe Gly Glu Asn Gln Met Val Asn Ser Gly Ile Lys Phe Tyr 105 110 115

Arg Arg Tyr Lys Ala Leu Ala Arg Lys Ile Val Pro Phe Ile Arg Ala 120 125 130

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Phe Gln Ser Ala Lys Leu Ala Asp Pro Gly Ser Gln Pro His Gln Ala

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- Glu Trp Arg His Tyr Asp Tyr Leu Gln Ser Leu Lys Lys Tyr Tyr Gly 265 270 275
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135

130

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		gac Asp														144
		tac Tyr														192
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Arg His Gly Ala Arg Tyr Pro Thr Ser Ser Lys Ser Lys Ala Tyr Ser 60 65 70	
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Ala	Arg	Leu 220	Glu	Ala	His	Leu	Pro 225	Gly	Val	Asn	Leu	Thr 230	Asp	Glu	Asp
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Phe	Phe	Ala	Leu	Gly 350	Leu	Tyr	Asn	Gly	Thr 355	Lys	Pro	Leu	Ser	Thr 360	Thr

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Tyr Gly Ala Gly Asn Pro Leu Gly Pro Ala Gln Gly Val Gly Phe Val 285 290 295

Asn Glu Leu Ile Ala Arg Leu Thr His Ser Pro Val Gln Asp His Thr 300 305 310

Ser Thr Asn His Thr Leu Asp Ser Asn Pro Ala Thr Phe Pro Leu Asn 315 320 325

Ala Thr Leu Tyr Ala Asp Phe Ser His Asp Asn Thr Met Val Ser Ile 330 345

Ser Val Glu Ser Ile Glu Glu Thr Asp Gly Tyr Ser Ala Ser Trp Thr 365 370 375

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BY

210

220

215

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